FIG. 3.—General view of Old Baldy and Cucamonga Mountains looking toward north-northeast. 13, 13. The round head of Old Baldy at the head of San Antonio Canyon. 14, 14. The summit of the highest peak, Cucamonga.

In the single view, fig. 3, also taken with the same rear combination and ray filter, the following points will be noticed:

13, 13. The round head of Old Baldy, at the head of San Antonio Canyon, which is 15 miles beyond the head of Cucamonga Canyon.

14, 14. The summit of the highest peak, Cucamonga.

Fig. 3 was taken about 7 a. m. and shows with what rapidity the storm clouds of three days previous have been swept from the sky by the north wind. We expect danger from the frosts in the citrus orchards succeeding a day of such clear, cold weather on the mountains, but in nearly all cases the frost is happily averted by a slight wind, and the thermometer goes to its lowest point during the hour before sunrise, dropping say from 36° to 26° in an hour, and rising again after the sun comes up. These north winds are charged with electricity, which visibly affects the hair in the manes and tails of horses, and causes an exceeding irritability and depressing headache in some human beings. These conditions generally exist for a period of three days, and although the wind blows hard it rarely causes much damage to trees or fruit in the orchards.

THE EARTHQUAKE OF DECEMBER 5, 1903, AT WASHINGTON, D. C.

By Prof. Charles F. Marvin.

The seismograph of the Weather Bureau recorded a slight earthquake from a very distant origin on the night of December 4–5, 1903. The apparatus by which this record was made has already been described in the MONTHLY WEATHER REVIEW for June, 1903, page 271. The north and south component of horizontal motion only is recorded.

The "principal portion" of the earthquake was noticeably short; the first portion consisting of only two or three waves of small amplitude, but relatively long periods (fifteen seconds for the duration of one complete vibration) followed by a single, relatively long wave with about the same period, and representing a displacement of the ground of about 0.26 of a millimeter (double amplitude). The period of the pendulum is 26 seconds, and the magnification 10.

The following table gives the corrected times of the principal phases of this earthquake:

December 5, 1903, a. m., seventy-fifth meridian time.

	h.	m.	s.	h.	m.	s.	
First preliminary tremor				0	26	20	a. m.
Second preliminary tremor				0	32	32	a. m.
Duration of first preliminary tremor	0	6	12				
Duration of second preliminary tremor	0	3	13				
Principal portion began				0	35	45	a. m.
Principal portion ended				0	36	50	a. m.
Duration of principal portion	0	1	15				
Duration of end portion	0	24	42				
End of earthquake				1	1	32	a. m.

This is the third earthquake that has been distinctly recorded at the Weather Bureau since the present seismograph was installed about the middle of February, 1903.

MOUNT WHITNEY AS A SITE FOR A METEOROLOGICAL OBSERVATORY.

By ALEXANDER G. MCADIE, Professor of Meteorology.

In reply to a letter dated June 15, 1903, from the Chief of the Weather Bureau, asking for a report on the advantages and disadvantages of Mount Whitney as a site for a meteorological observatory in connection with the proposed astrophysical observatory, I have the honor to submit the accom-

panying notes based on observations made during a hasty trip to the summit in July, 1903, in company with the Sierra Club of San Francisco.

ACCESSIBILITY.

Mount Whitney is situated in latitude 36° 34′ 33″ north, and longitude 118° 17′ 32″ west. It may be reached in several ways.

I. From Lone Pine on the Carson and Colorado Railroad, along the county roads to Carroll Creek, up zig zags of a trail, across Cottonwood Creek to Horseshoe Meadow, a climb of nearly 5000 feet in 10 miles, and thence by trail to Volcano Mountain.

II. By trail from the Kern River, at its southern end, working north along the Kern River to the East Fork, thence south to Crabtree Meadow, thence to Langley's Camp on the eastern side of Mount Whitney, 2800[1] feet below the summit.

III. From the northern end of Kern River working south to East Fork, thence as in II.

The trails on the western side of the mountain are not steep, nor especially difficult and dangerous. A good climber can go from Langley's Camp to the summit in less than four hours.

On the top of the mountain, or peak, is a flat of several acres. On the extreme eastern edge, a small monument of rocks has been erected. The eastern side of the peak is precipitous, a sheer fall of about 6000 feet sharply marking the mountain. About 11,000 feet below the summit lies the valley of Owens River, with Owens Lake to the southeast. On a clear, quiet day Lone Pine, almost directly east of Mount Whitney and distant about 15 miles, can be seen. Independence, lying to the north-northeast, is hidden by a ridge. Between Independence and Lone Pine six streams flow to the east. The most important of these is Lone Pine Creek, which flows down from Mount Whitney. According to the report of Mr. Charles C. Garrett, Observer at Independence, Cal., dated June 17, 1903, the quantity of water in this creek is as follows:

The flow of the stream varies very much in different years. Measurements taken two days ago at my request showed a flow of 660 miner's inches. The water is now at its highest point, and this is regarded as an average year. It is probable that at the time of lowest water not more than 80 inches flow. Measurements were taken in the months of October and December, 1893, for testimony in a water suit, and flows of 195 and 160 inches, respectively, were found. The principal owner of the waters of Little Pine Creek informs me that, in his opinion, the average flow of the stream for an average year is about 300 miners' inches.

On the eastern side of the mountain there are at least four lakes within 3 miles. There is a splendid supply of good water at Langley's Camp. Mount Whitney is in the Mount Whitney Military Reservation, and I am under the impression that one of the reasons urged in establishing the reservation was the desire to retain it for use as a station for scientific research.

The peculiar character of Mount Whitney renders it a good site for meteorological work, inasmuch as comparisons can be made of the conditions in the free air over a confined and heated valley and the conditions existing on the westward slope of the Sierra, or plateau conditions. While we were on the summit a lady's veil was thrown over the eastern edge, and, although the temperature was but 53°, it was plain that there were high temperatures and strong ascensional currents on the eastern side of the mountain. The course of the veil was such as to suggest that with regard to the general flow of the air from west to east the mountain acts as a dam, or weir.

It is probable that for the greater portion of the year the peak is accessible. The average precipitation in this section is not very large. Snow remains in the crevasses until August or September. At the time of our ascent, July 8, 1903, we passed across one crevasse which, however, could have been avoided by making a detour south of the gully. I do not know that the peak has ever been ascended in winter, but I believe there are periods when this would be possible. No one of the other high mountains on the Pacific slope, such as Shasta or Rainier, is so easy to climb as Mount Whitney. Owing to the fact that the two peaks mentioned lie further north and in the track of atmospheric disturbances, climbing is almost out of the question in winter, and hazardous even in summer. Mount Whitney, therefore, of all the extremely high peaks on the Pacific coast, is probably most suitable for a meteorological observatory.

All materials would have to be carried up by pack train. I made some inquiry as to prices for this work, but could obtain no trustworthy estimates.

[1] 3000 feet is probably a more accurate figure.

THE ELEVATION OF MOUNT WHITNEY.

As will be seen below few mountain elevations have been discussed more carefully than that of Mount Whitney. Some barometric observations were made on our trip, although it was a hasty one and not altogether favorable for such work. Fortunately the weather conditions were very favorable. The greatest care was taken by Prof. J. N. LeConte and myself to read carefully, and independently of each other, the heights of the mercurial column. Our chief purpose was to correct the prevailing estimate of the height of Mount Whitney, viz, 14,900 feet, an elevation given on most of the maps in use in California.

Gannett, in his Dictionary of Altitudes in the United States, third edition, 1899, gives an elevation of 14,898 feet, and this we believe to be erroneous. The authority given is Whitney, but I am unable to ascertain if Professor Whitney made the ascent and measurement, or, as chief of the geological survey of California, used the measurement made by Carl Rabe for the Survey. This latter was the first measurement of Mount Whitney. His readings as marked on the case of the mountain mercurial barometer, Green No. 1554, used by him, are 17.836 inches, 32°; 17.848 inches, 42°.

The elevation deduced from the above readings was 14,898 feet, or exactly the same as the figures given by Gannett. This elevation, however, does not seem to be in accord with the readings, and if the altitude is determined on the assumption that the correction applied to the barometer was the same as applied in our observations (a doubtful assumption it is true), the elevation would be about 13,701 feet, the sea-level pressure on that date being 30.01 inches at the given hour, the value of the mean temperature being 37.5 °F. and the corrected reading at Mount Whitney being 17,915 inches.

Two mercurial barometers were carried from San Francisco to Mount Whitney summit and read at half hourly intervals by Prof. J. N. LeConte, University of California, and myself. One of the barometers was the same instrument used by Rabe, Green No. 1554. Our readings on the summit were as follows:

Summit of Mount Whitney, July 8, 1903. Observers: J. N. LeConte and A. G. McAdie.

Pacific time.	Green, No. 1554.		Green, No. 1664.	
	Barometer.	Attached thermometer.	Barometer.	Attached thermometer.
	Inches.	°F.	*Inches.*	°F.
9:30 a. m.	17.630	51	17.652	54
10:00 a. m.	17.638	51	17.652	55
10:30 a. m.	17.646	55	17.660	55
11:00 a. m.	17.650	55	17.660	54
11:30 a. m.	17.650	50	17.667	52
12:00 noon	17.650	49	17.668	51
12:30 p. m.	17.652	48	17.674	54
1:00 p. m.	17.654	49.5	17.674	53
	17.646	51.7	17.663	
	− 0.036*		− 0.041*	
	17.610		17.622	
	+ 0.088†		+ 0.068†	
	17.698		17.690	

*Reduction to standard temperature.
†Sum total of the probable instrumental error, scale correction, capillarity, and gravity corrections for latitude 37° and for altitude 15,000 feet.

The mean of our pressure readings on the summit was 17.690 inches, while the mean of the Langley readings was 17.588 inches. There are only four of the series by Langley which were taken at hours comparable with ours, namely, September 4, 8:30 a. m.; September 5, 12:40 p. m.; September 6, 8:17 a. m.; and September 6, 9 a. m. The mean of these corrected and reduced is 17.609 inches. The difference, therefore, is but 0.081 of an inch. The temperatures also agree fairly well.

Professor Langley gives the elevation of Mount Whitney as 14,522 feet, or 10,762 feet above his base station at Lone Pine.[2]

We found deposited on the summit a record of an ascent made on August 23, 1902, by Professors Kellogg, Hallock, Putnam, and others, in which it is stated that the temperature was then 34° F., and the boiling point, as determined by Wm. Hallock, 186.4° F. It is interesting to note that the pressure corresponding to this boiling point would be 17.58 inches.

On October 8, 1895, Hutchings and others ascended the mountain and reported that water boiled at 187° F.

WHEELER'S DETERMINATIONS.

Wheeler gives as the height[3] determined by the adopted mean of barometric observations made by the observers of his survey party of 1875, 14,471 feet. The mean of three readings, at half hour intervals, on September 24, 1875, after being corrected and reduced, was 17.796 inches; temperature, 35.3°; wet bulb reading, 29.0°. A similar mean for October 13, 1875, was 17.840 inches; temperature, 36.7°; wet bulb reading, 32.2°. The corrections applied are not accessible, but the records are probably in the office of the Chief of Engineers, U. S. Army.

The record of the observations made by Rabe in 1873, with the barometer, Green No. 1554, is as follows:

Barometer.	Attached thermometer.
Inches.	° *F.*
17.836	33
17.848	42
17.842	38
— 0.015*	
17.827	

These readings, corrected for temperature only, differ from the values obtained by us, by +0.217 inches. The difference from the readings of the other barometer, Green No. 1664, was +0.205 inches. It will be noticed that there is a decrease in temperature during the observations as shown by both attached thermometers, and moreover the temperatures themselves are not similar. Barometer No. 1554 is a small mountain barometer with a scale reading from 24 to 11 inches. Barometer No. 1664 has a scale reading from 33 to 14 inches. Both instruments were filled with clean mercury June 23, 1903, and the longer instrument carefully read and compared with station barometer No. 387 in the Weather Bureau office at San Francisco. Its mean correction was +0.068 inches. It may be questioned whether this correction properly applies to readings at high elevation, but for the present we will assume that it does so.

Simultaneous pressure readings, July 8, 1903.

Hour (Pacific time).	Mount Whitney.	Independence. Elevation 3910 feet.	Mount Tamalpais. Elevation 2375 feet.	San Francisco. Elevation 155 feet.
10 a. m.	17.680	25.965	27.55	29.90
11 a. m.	17.689	25.953	27.56	29.89
12 noon	17.701	25.936	27.56	29.88
1 p. m.	17.704	25.919	27.56	29.86

[2] The exact elevation of the station at Lone Pine is uncertain.

[3] United States Geological Surveys West of the One Hundredth Meridian. Wheeler, 1889, p. 95.

The above are the so-called station pressures, that is, the observed readings corrected for temperature, scale correction, capillarity, and gravity. Independence is the Weather Bureau station nearest to Mount Whitney, and the observations were made at that point by Mr. Charles C. Garrett.

The sea-level pressures at Independence and at San Francisco were as follows:

Hour.	Independence.	San Francisco.
10 a. m.	29.88	30.06
11 a. m.	29.86	30.05
12 noon	29.85	30.04
1 p. m.	29.82	30.02
Mean	29.85	30.04

The observations at San Francisco and at Mount Whitney can be used to determine the elevation of the latter above sea level.

Professor Bigelow's modification of the Laplacian equation, as given on page 490, equation 60, of his report on International Cloud Observations, Vol. II of the Report of the Chief of the United States Weather Bureau, 1898–99, or equation 52, p. 66, of his Report on the Barometry of the United States, etc., Annual Report of the Chief of the United States Weather Bureau, 1900–1901, Vol. II, is as follows:

$$h - h_o = (56517 + 123.3\theta + 0.003h)\left(1 + 0.378\,\frac{e}{B}\right)(1 + 0.0026\cos 2\varphi)\log\frac{B_o}{B}.$$

Using the values for 10 a. m. July 8, $B_o = 30.06$ inches, as at San Francisco, $B = 17.680$ inches, as on Mount Whitney, and a mean temperature $\theta = 53°$, we obtain

$$\log B_o = \log B + \frac{h - h_o}{56517 + 123.3\,(53) + 0.003h}\left(1-\beta\right)\left(1-\gamma\right),$$

whence $h = 63096 \times 0.230507 = 14{,}515$ feet.[4]

PREVIOUS DETERMINATIONS OF ALTITUDE.

On page 201 of his Researches on Solar Heat (Professional Paper of the Signal Service No. 15), Professor Langley gives what is probably the best series of observations as yet made on Mount Whitney. The observers were Mr. E. O. Michaelis, Mr. J. J. Nanry, and Mr. J. E. Keller.

The readings given in Table 173 of his work are as follows:

Reading of barometer No. 2018, Signal Service, on the summit of Mount Whitney.

Date.	Time.	Reading.	Attached thermometer.	Reading.*
1881.		*Inches.*	° *F.*	*Inches.*
September 2	6:00 p. m.	17.600	30.0	17.599
2	9:00 p. m.	17.597	26.5	17.603
2	12 midn't.	17.569	25.5	17.576
3	3:00 a. m.	17.529	22.5	17.540
3	6:00 a. m.	17.518	22.5	17.529
3	8:15 p. m.	17.514	28.2	17.516
4	8:30 a. m.	17.627	52.8	17.591
5	12:40 p. m.	17.600	62.5	17.546
5	5:07 p. m.	17.680	61.5	17.628
5	6:30 p. m.	17.640	42.0	17.622
5	8:20 p. m.	17.599	38.0	17.588
5	10:22 p. m.	17.558	32.0	17.555
5	12 midn't.	17.558	31.5	17.555
6	1:00 a. m.	17.610	30.0	17.610
6	3:00 a. m.	17.610	30.0	17.610
6	5:00 a. m.	17.610	28.0	17.613
6	8:17 a. m.	17.692	52.0	17.657
6	9:00 a. m.	17.680	54.4	17.640

*Corrected for temperature and reduced to Signal Service standard but not for gravity.

[4] The editor having kindly pointed out that I had not made full use of the Independence readings, I give herewith the following values: 10 a. m., 14,441 feet; 11 a. m., 14,414 feet; noon, 14,378 feet; 1 p. m., 14,355 feet, which, as the editor remarks, are to be considered as only a portion of a continuous 24-hour series.

Having also seen Mr. Heiskell's computations I would add that the values 14,530 and 14,532 obtained by him by using the Bigelow tables agree with the values obtained above in which the value of θ was 53°,

Measurements of the height by angles of elevation and depression between Old Camp Independence, Lone Pine, and the Peak and return, give a result of 14,470 feet.[5] "It is," says Wheeler,[6] "the highest point measured by careful barometric observations within the territory of the United States, except Alaska."

HISTORICAL NOTES.[7]

The mountain was first seen from Mount Brewer by members of the geological survey of California, Brewer, King, and others, in 1864, and named Mount Whitney. On August 18, 1873, John Lucas, C. D. Bigole, and A. H. Johnson, climbed the peak and called it Fisherman's Peak. On September 1, 1873, Clarence King, then in New York, learned that the peak which he had climbed in 1871, now known as Sheep Mountain, Old Mount Whitney, and Mount Corcoran (Bierstadt) lying to the south of Whitney, was not Mount Whitney, and hastening west climbed the right peak September 19, 1873. On September 6, 1873, the mountain was climbed by Carl Rabe, and the first mercurial barometer, Green, No. 1554, carried to the summit. Professor Langley's expedition is well known. He reached Lone Pine on July 24, 1881, and left on September 10 by way of Lone Pine canyon. The journey, in brief, is described in pages 36 to 44, Professional Paper No. 15, Signal Service, published in 1884.

I can not do better than quote Professor Langley's statement given on page 44:

> I do not think the Italian Government, in its observatory on Etna, the French, in that of the Puy de Dome, or any other nation at any other occupied station, has a finer site for such a purpose than the United States possess in Whitney and its neighboring peaks; and it is most earnestly to be hoped that something more than a mere ordinary meteorological station will be finally erected here and that the almost unequaled advantages of this site will be developed by the Government.

COMPUTATION OF THE ALTITUDE OF MOUNT WHITNEY.

A report by Mr. H. L. HEISKELL to Prof. F. H. BIGELOW, dated October 2, 1903.

Relative to the observations made on Mount Whitney, Cal., by Professor McAdie on July 8, 1903, at 10 a. m., 11 a. m., noon, and 1 p. m., and used by him in connection with simultaneous observations taken at Independence, San Francisco, and Mount Tamalpais, to determine the height of the summit, I find that the observations are too few, and taken at a bad time of the day, to give any very accurate results.

Three essential elements must be considered in barometric hypsometry: temperature, pressure, and vapor pressure, and the observations should be taken at different times of the day and on different days, so as to obtain a true mean; an error of one degree in mean temperature causes an error of 20 feet in the height of Mount Whitney; an error of .001 of an inch in pressure causes an error of one foot in the computed height. In these observations the attached thermometer is read for temperature and there are no hygrometric observations; then again the temperature at Independence, etc., was taken from the thermograph, so that a possible error of from 100 to 200 feet is not improbable.

From the data available, using your formula in your Barometry Report, I make the height of Mount Whitney as follows:

	Feet.
By using the simultaneous observations taken by the observer at Independence and by Professor McAdie at Mount Whitney, the elevation is	14 651
San Francisco and Mount Whitney	14 532
Mount Tamalpais and Mount Whitney	14 618
Mean	14 600

If we reduce the observations at Independence, San Francisco, and Mount Tamalpais to sea level and then compute to Mount Whitney, we have,

	Feet.
Independence and Mount Whitney	14 590
San Francisco and Mount Whitney	14 532
Mount Tamalpais and Mount Whitney	14 595
Mean	14 572

or a difference of 28 feet from the preceding.

Professor McAdie, using observations taken at San Francisco only, calculates the height as 14 515.

On September 2, 3, 4, 5, and 6, 1881, Professor Langley had a very accurate and careful series of 18 simultaneous observations taken at Lone Pine and Mount Whitney and published in his Researches on Solar Heat. His barometers were carefully compared and his temperature and hygrometer observations were made by experienced observers, so that the accuracy of the work can hardly be questioned. In 1900 Mr. Gannett deduced from railroad levels the elevation of Lone Pine as 3661 feet above sea level, but in 1881 the height of Lone Pine was given by Mr. George Davidson to Professor Langley as 3760 feet, or nearly 100 feet higher. The means of 18 simultaneous observations at the two points are as follows:

Lone Pine.		Mount Whitney.	
Pressure	26.018	Pressure	17.586
Temperature	69.57	Temperature	37.20

Using the height of Lone Pine, as given by Mr Gannett in 1900 (3661 feet), and the barometric observations of Professor Langley, I make the height of Mount Whitney 14,423.

Professor Langley, in his report, using 3883 feet for Lone Pine and his own barometric work, says Mount Whitney, by barometer observations, is 14,625.

Professor Langley, by using Davidson's altitude, 3760 feet, for Lone Pine and barometer observations at Mount Whitney, makes the height 14,522.

On August 17 to September 7, 1881, Professor Langley had 16 simultaneous observations taken at Lone Pine and Mountain Camp to determine the height of the camp; to see how we agree on that height I herewith give the data:

Using Davidson's height of Lone Pine, 3760 feet, the height of Mountain Camp is 11,624.

Using Gannett's height of Lone Pine, 3661 feet, Mountain Camp is 11,525.

Professor Langley makes Mountain Camp 11,625.

From the above, I should say that the approximate heights are:

Lone Pine, Gannett, 3661.

Mountain Camp, Gannett and Langley, reduced by me, 11,525.

Mount Whitney, Gannett and Langley, reduced by me, 14,423.

I should, therefore, suggest that the adopted height of Mount Whitney be about 14,423 feet, as determined by using Professor Langley's observations and Professor Gannett's height in 1900 for Lone Pine.[1]

or a degree less than that used by him. Recomputing the elevation, but using a temperature of 54° and sea-level pressure of 30.06 my computation gives 14,572. The sea-level pressure used by Mr. Heiskell was 30.04 inches and the station pressures 17.694, which, according to the method of computation used above, would give an elevation of 14,534 feet.—A. M., November 20, 1903.

[5] But this depends upon the height of Lone Pine depot; and this in turn upon the elevation of Mound House on the Virginia and Truckee Railroad.

[6] Quoted above.

[7] References: Langley—Researches on Solar Heat. Wheeler—Surveys West of One Hundredth Meridian, 1889. Steuart—Mount Whitney Club, Visalia, Cal. LeConte—Sierra Club Bulletin.

[1] A letter from Professor McAdie makes it very doubtful whether the hamlet "Lone Pine," occupied by Professor Langley, in 1881, is the same as the railroad station "Lone Pine," subsequently established. Other letters will be found on page 533.—ED.